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(54) Abstract Title
USSD signal call connection for mobile

(57) A controller identifies a telephone number request within an Unstructured Supplementary Service Data (USSD) signal received from a mobile phone. A connection is then set up with the requested number, and information determined from the USSD signal relating to the identity of the mobile telephone number is passed to the called party. The requested number may be a short code number, or a respective voice mailbox. The controller may access a credit database before making the connection.

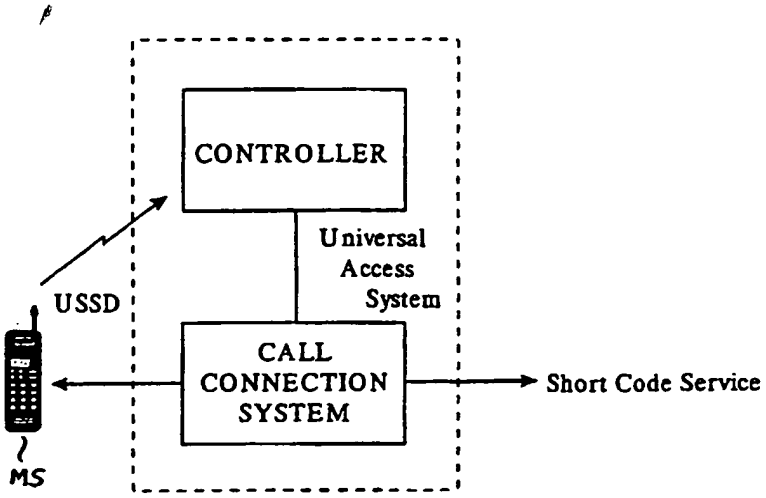


Figure 1

GB 2 367 218

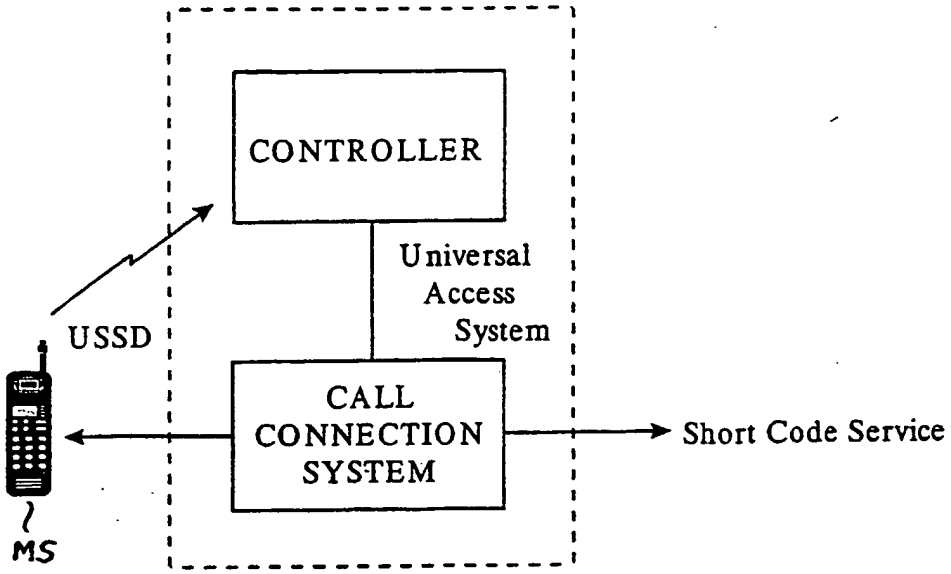

CONTROLLER
Universal
Access
System
USSD
CALL
CONNECTION
SYSTEM
Short Code Service
MS

Figure 1

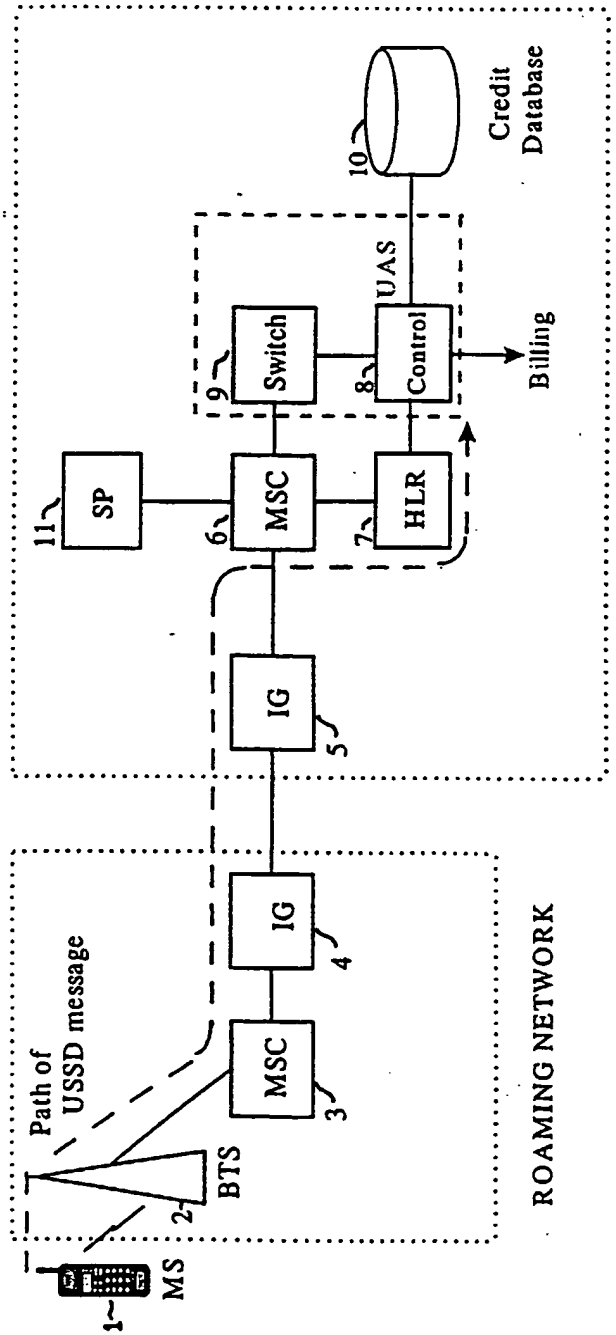
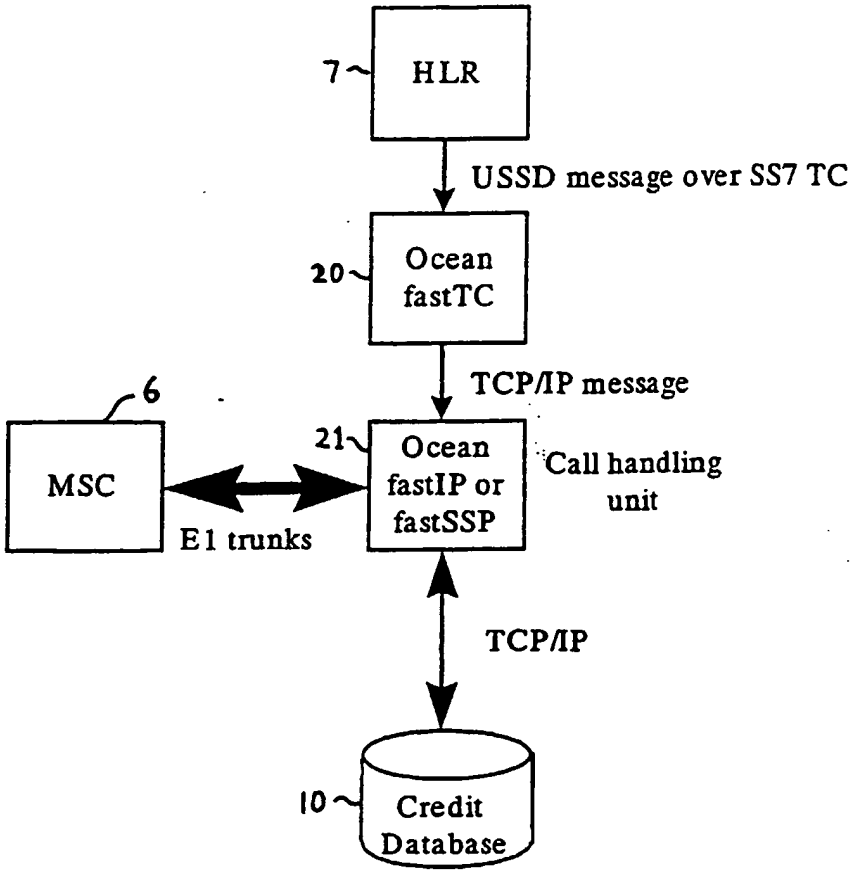

HOME NETWORK
ROAMING NETWORK
Credit Database
10
UAS
Switch
9
Control
8
Billing
SP
11
MSC
6
HLR
7
IG
5
IG
4
MSC
3
BTS
2
MS
1
Path of USSD message

Figure 2

Figure 3


7
HLR
USSD message over SS7 TC
20
Ocean
fastTC
TCP/IP message
6
MSC
21
Ocean
fastIP or
fastSSP
Call handling
unit
E1 trunks
TCP/IP
10
Credit
Database

TELECOMMUNICATIONS SERVICES APPARATUS

This invention relates to a telecommunications services apparatus for use with a mobile radio telecommunications system, such as a mobile telephone system.

Mobile telephone ownership and usage has been increasing dramatically.

In order to attract new customers and to retain existing customers, mobile network operators are introducing a range of value added services, many of which are accessed by short codes.

Examples of such services in the UK, and their short access codes include:

901 for BT Cellnet Voicemail
902 for BT Cellnet Voicemail Plus
121 for Vodafone Recall (voicemail)
1200 for BT Cellnet Traffic Line
1222 for BT Cellnet Dictation Line
333 for Vodafone SCOOT information service

Other services accessed by short code include:

100 for the operator
192 for UK directory enquiries
121 for One 2 One Customer Services
453 for Orange Pre-pay balance enquiries

However, more people are now travelling outside their own country and many of them would like to be able to take full advantage of the communications flexibility that they enjoy with mobile phones in their home country.

Contract (post-pay) mobile subscribers have generally been able to use their mobile phones in many countries, wherever their home network operator has a roaming agreement with a foreign network operator.

However, there is generally a problem for roaming users as they cannot normally access home network services via short codes. This creates significant

difficulties in accessing basic services, such as voicemail, and may make it impossible to reach other value added services.

For example, rather than just dial 901 to access their BT Cellnet voice mailbox, a roaming user must either dial a special mailbox number or dial their own number with the network set to divert on busy to voicemail. It may also be necessary to enter their own mobile number before gaining access. The user experience is very different depending upon whether the user is at home or roaming.

The reason that one cannot just dial 901 to access BT Cellnet voicemail when roaming is that generally the foreign network assumes that the caller wishes to access the number 901 in that country, on that network. For example, in Spain, the number 901 XXXXXX identifies a shared revenue service (similar to a UK 0845 service) and the network would therefore assume that '901' represented an incomplete number.

The mobile telephony community is working on standards that may enable users to dial their home network short codes whilst roaming on foreign networks, notably the CAMEL (Customised Applications for Mobile Network Enhanced Logic) specifications, but it could take some years before they are fully defined, implemented by manufacturers and then deployed by network operators throughout the world.

A solution that would work today is highly desirable.

Some network operators have encouraged their counterparts in other countries to put some intelligence within their networks for bi-partisan arrangements. This can help in some cases but it is far from a complete solution.

For example, KPN Mobile of the Netherlands has implemented logic within its network to allow a BT Cellnet user roaming on the KPN Mobile network to dial 901 and gain immediate access to their mailbox in the UK. KPN Mobile has requested UK networks to provide a similar facility for its customers roaming in the UK. KPN Mobile uses 333 for voicemail access and it is now possible for a KPN Mobile user roaming on the BT Cellnet network to dial 333 and access their mailbox in the Netherlands. However, a KPN Mobile user roaming on the Vodafone network in the UK and dialling 333 accesses the Vodafone SCOOT information service .

Now, it could be imagined that Vodafone might be able to implement logic within its network to detect that 333 had been dialled by a KPN Mobile roamer and re-route the call to the Netherlands rather than to SCOOT. However, this would not

necessarily be desirable since there may be occasions when the roamer would actually want to access SCOOT to obtain information.

Even when such arrangements are possible they are likely to be implemented only for key services such as voicemail. Mobile operators are rapidly introducing new services in attempts to differentiate; many of these are on short codes and keeping knowledge of these numbers up-to-date is difficult.

A further problem currently exists within many mobile networks. The Calling Line Identity (CLI) of a handset, which is often used to influence the content of a service (for example, to access the appropriate mailbox), is not always passed across international links so even if it were possible to access a home network short code service whilst roaming, it may not be possible to easily reach the desired result or content.

Thus, it can be seen that use of short codes when roaming is difficult and haphazard. Future intelligent network functionality may provide the answer but in the meantime, a solution that is available today and provides universal access would be highly desirable.

For mobile pre-pay users, roaming is possible today on some networks. For example, on some networks USSD (Unstructured Supplementary Service Data) is used to alert the network that the user wishes to make an outgoing call whilst roaming. USSD commands are intended for control of supplementary services and are passed through the network without charge. Certain classes of USSD commands are defined as being passed back to the home network, and so are ideal for this purpose. The user enters a particular USSD command into his handset and sends it to the network on which he is currently roaming. The command used may be one of the ETSI defined commands intended for a different purpose, or may be one of the reserved or undefined commands which are available.

When the home network receives at one of its HLRs (Home Location Registers) one of these commands from a roaming user, it initiates an outgoing call from the home network to the roaming mobile. As the call originates from the home network, billing and credit checking can operate successfully in the home network thereby preventing fraud problems. The user then receives the call back on his mobile and typically interacts with an automated announcement system to enter his desired

destination number or service – the network then completes the call. Credit checking for the call then proceeds in the normal way, as for a call made from the home network.

An alternative way to alert the home network to the roamer's desire to use a service is the Short Message Service (SMS). Instead of sending a USSD message, the user enters an SMS message and sends it to a defined number in the home network. For this to be possible, the SMS service has to be enabled for the roaming user, which opens the possibility of the user being able to send SMS messages to other destinations when he does not have sufficient credit. This method is therefore less attractive than USSD.

According to the invention there is provided a telecommunications services apparatus for use with a mobile radio telecommunications system, said apparatus comprising:

a controller for receiving a USSD (Unstructured Supplementary Service Data) signal from a mobile station of the mobile radio telecommunications system, and for extracting a requested telephone number from the USSD signal; and

a call connection means for outdialling to said requested telephone number and to said mobile station, and for connecting said requested telephone number and said mobile station, said call connection means also sending an identification signal characteristic of the telephone number of said mobile station to said requested telephone number, said identification signal being derived from the signalling information provided by said mobile radio telecommunications system in conjunction with the USSD signal.

A preferred embodiment of the invention provides a universal access system allowing roaming mobile users to access services that are available on short codes in their home network in a simple manner. It may be applicable to both post-pay and pre-pay users.

The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Figure 1 is a block diagram of a telecommunications services apparatus in accordance with an embodiment of the invention, comprising a universal access system;

Figure 2 is a block diagram showing a network configuration of the universal access system; and

Figure 3 is a diagram showing an implementation of the universal access system.

Referring to Figure 1, there is shown a universal access system comprising a call connection system and a controller. The call connection system provides communication to a short code service, and also to a selected mobile station MS.

The system uses the USSD scheme described above to enable a user to indicate to the network that they wish to call a short code service.

The USSD command sent by the user is basically of the form

#<sc>*<telno>#

where <sc> is the service code

and <telno> is the short code telephone number which the user wishes to call.

The universal access system, which is located within the home mobile operator's network, places a call back to the user. Once connected , the system then places a call to the short code service indicated by <telno> and makes the connection between the user and the short code service.

Figure 2 shows a mobile station MS (1) of a roaming mobile user communicating with a roaming network comprising a base station transmission system BTS (2), a mobile switching centre MSC (3) and an international gateway IG (4). The roaming network is shown as communicating with the roaming user's home network, which includes an international gateway IG (5), a mobile switching centre MSC (6), a home location register HLR (7), and a universal access system UAS embodying the invention, the system including a service control function (8) and an intelligent telephony switch (9). The home network also includes a credit database (10) and a

service platform SP (11) allowing access to the system providing the service that has been accessed by the short code.

In Figure 2, the roaming mobile user (1) wishes to access a short code service in the home network. He sends a USSD message which is transmitted through the roaming and home networks to arrive at the service control function (8). The switch (9) dials back to the roaming subscriber and to the service platform (11) and connects the parties together.

At the end of the call, if the user is a contract (post-pay) customer, the system produces billing information in the form of Call Detail Records (CDRs) for both legs of the call. The CDRs are processed by the mobile network operator's billing system with both call legs billed to the user.

However, if the user is a pre-pay customer, then it is necessary to check in the credit database (10) prior to calling the service platform (11) that the user has sufficient credit for a call. Then, during the call the remaining credit is monitored with imminent expiry warnings provided if appropriate and the call cleared down if credit expires. The credit database (10) is updated as appropriate.

Figure 3 shows a preferred embodiment of the core processing elements of the system. The HLR (7) is connected to a fast transaction converter, such as an Ocean fastTC (20) manufactured by Telsis Limited, and is able to forward USSD codes received from roaming mobiles to the fastTC (20). The fastTC (20) communicates with a call handling unit (21), such as an Ocean fastIP or fast SSP manufactured by Telsis Limited, over TCP/IP. The call handling unit (21) is able to make calls via E1 connections to the rest of the network via the MSC (6), and to interact with the caller using voice prompting and DTMF detection functions, which are integral to the call handling units. It is also able to communicate with credit and billing control systems such as the credit database (10). If credit runs out it is able to clear down the call.

ETSI has defined (in the GSM system, GSM 02.30 and GSM 02.90) a range of USSD commands and codes for control of specified supplementary services. In addition, ranges of code values are reserved for communication between a mobile handset and the home location register in the home network and the visitor location register in the visited network.

USSD commands take the form:

<operation><service code>*<supplementary information>#

where <operation> is, for example

*	for service activation or registration
#	for service de-activation
*#	for service interrogation
**	for service registration
##	for service erasure

<service code> is a 2 or 3 digit number

<supplementary information> is one or more strings of digits separated by *.

Network operators who have already implemented pre-pay roaming services based on USSD as described above have chosen different approaches. For example, one operator has chosen to use the service code 100 which is within the range allocated for communication with the HLR, whilst another operator has chosen to re-use code 33 (specified for control of Outgoing Call Barring) for this purpose.

The choice of actual USSD code to be used with the preferred system therefore lies with the network operator. It needs to choose the appropriate code that will enable USSD messages to be delivered to the system.

For the purposes of example, we shall describe use of the code 144, which is within the range reserved for communications with the HLR.

In the preferred embodiment a BT Cellnet user (for example) sends the USSD command

*144*901#

to request a call to access voicemail.

On receiving this USSD code from a mobile handset, the HLR (7) forwards the command via the Ocean fastTC (20) which translates the message from USSD into TCP/IP and passes it to the Ocean call handling unit (21).

The Ocean call handling unit (21) needs to know the telephone number of the user's mobile (the MSISDN – Mobile Station ISDN number). The HLR (7) holds the MSISDN and can provide it when presented with the IMSI (International Mobile Subscriber Identity) which uniquely identifies the SIM (Subscriber Identity Module) in the handset. The IMSI is part of the USSD message and the HLR (7) can either look-up the MSISDN and include it with the message sent to the fastTC (20) or alternatively, having received the USSD message, the fastTC (20) can interrogate the HLR (7) to determine the MSISDN from the IMSI.

The call handling unit (21) dials back to the user (using the MSISDN) and, when the call is answered, provides an announcement of the form:

Please hold while we connect you to the 901 service

Assuming the call is answered by the user, the call handling unit (21) dials 901 and then makes the connection between the user and the voicemail system. The signalling information passed to the voicemail system includes the CLI of the user (the MSISDN), just as if the user were calling from within the home network.

The outdial back to the user must not be diverted to voice mail even if the mobile is set up to divert all calls. The diversion is avoided by setting correct parameters in the outdialled call signalling information, typically by using a number prefix which is passed through the MSCs and interpreted as an instruction not to divert the call. Unconditional call forwarding (CFU) can be bypassed in this way since it is implemented at the HLR, while conditional forwarding is implemented in the VLR (Visitor Location Register) which will be in the roaming network. CFU to voicemail is usually the only type of divert permitted for pre-pay users, as this prevents them from diverting calls to other numbers which would incur a call cost (e.g. international or other mobile numbers). However, post-pay users who use conditional diverts may need to turn them off whilst they use this service, as otherwise there is a small chance that one of the divert conditions will arise between the user sending the USSD

message and receiving the call back. It is possible that the system can interrogate the HLR to determine whether any diverts are set-up and if so inform the user by means of USSD or SMS messages or voice announcement.

In an alternative implementation, the network operator may offer another method of accessing a short code service. In this case the required short code telephone number is not sent as part of the USSD command but is entered later as part of an interactive dialogue with the call handling unit.

The choice of USSD command lies with the network operator but may be of the form:

*144#

or *144*n# where n is one or more digits that indicate a short code service call request.

The command is passed to UAS as in the preferred embodiment, and the first call set up by the call handling unit back to the initiating mobile. However, now when the call is answered, the user is greeted and invited to key in the required short code phone number (typically terminated by #).

The DTMF digits representing the number are collected by the call handling unit and the call to the service platform is then made.

In some implementations the system may include a re-try feature if the call back to the user cannot be connected for any reason, for example, if another call has been answered in the meantime since sending the USSD command, or if radio signal has been lost.

The system described uses a USSD command to request access to a short code service. It would also be possible to use SMS for the same purpose, although this may not be preferred because SMS messaging is not necessarily available on all foreign networks and also it is a 'store and forward' system which means that there may be an (unacceptable) delay between transmission of the SMS request and its receipt at the system.

The preferred system adds a very useful feature for pre-pay and post-pay roaming customers, and the same principle can also be used to add other features. The

solution can be implemented very simply today without requiring any changes whatsoever to be made in the foreign networks; the only enhancements are made in the home network. This means that the solution will work in any foreign network which has a roaming agreement with the home network. It can also therefore be used in the home network alongside alternative solutions including CAMEL, allowing use from foreign networks which do not use an alternative solution yet.

Embodiment of the invention may also permit users to have access to the widest range of services by enabling differentiation between services with the same access code in home and foreign networks. Thus, in the example quoted above, a KPN Mobile customer roaming on the Vodafone UK network could dial 333 to access Vodafone's SCOOT service or *144*333# (or similar command) to access their voicemail in the Netherlands.

CLAIMS

1. A telecommunications services apparatus for use with a mobile radio telecommunications system, said apparatus comprising:

a controller for receiving a USSD (Unstructured Supplementary Service Data) signal from a mobile station of the mobile radio telecommunications system, and for extracting a requested telephone number from the USSD signal; and

a call connection means for outdialling to said requested telephone number and to said mobile station, and for connecting said requested telephone number and said mobile station, said call connection means also sending an identification signal characteristic of the telephone number of said mobile station to said requested telephone number, said identification signal being derived from the signalling information provided by said mobile radio telecommunications system in conjunction with the USSD signal.

2. Apparatus according to claim 1, including means for connecting the call connection means to a short code service, such that the requested telephone number may be a short code telephone number.

3. Apparatus according to claim 1 or claim 2, including means for accessing a credit database which can be interrogated for credit information prior to connecting the requested telephone number with the mobile station.

4. Apparatus according to claim 1, claim 2 or claim 3, wherein the call connection means is operable to connect the mobile station to the respective voice mailbox provided by the mobile radio telecommunications system.

5. A telecommunications services apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Application No: GB 0122949.1
Claims searched: 1-5

Examiner: Robert Shorthouse
Date f search: 29 December 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): H4L (LRCMC, LRCMX, LDPD, LDPC, LDPPX)

Int Cl (Ed.7): H04Q 7/22, /38, H04M 15/00

Other: Online: WPI, EPODOC, JAPIO, INSPEC

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	WO 00/07391 A1 (SWISSCOM) See abstract	-
A	WO 98/35481 A2 (URE) See abstract	-
A	WO 97/39564 A1 (MOTOROLA) See abstract	-
A	WO 97/37502 A1 (BRITISH TELECOM) See abstract	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.